

11. (Amended) An optical system for use in a projection exposure apparatus, said optical system comprising:

a plurality of lenses that cause birefringence; and

at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses.

12. An optical system according to claim 11, wherein said at least one optical element has form birefringence.

14. An optical system according to claim 12, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

15. An optical system according to claim 14, wherein said grating is provided on the surface of at least one of said lenses.

16. An optical system according to claim 11, wherein said at least one optical element has a stress distribution.

18. (Amended) A projection exposure apparatus comprising:

an illumination system for illuminating a reticle with light; and

a projection optical system for projecting a pattern of the reticle onto a wafer, said projection optical system including a plurality of lenses that cause birefringence, and at least one optical element for substantially eliminating the birefringence caused by said plurality of lenses.

19. A projection exposure apparatus according to claim 18, wherein said illumination system illuminates the reticle with slit-like light, and further comprising a scanning device for simultaneously scanning the reticle and the wafer in a widthwise direction of the slit-like light, at a speed ratio corresponding to a projection magnification of said projection optical system.

20. A projection exposure apparatus according to claim 18, wherein said at least one optical element has form birefringence.

22. A projection exposure apparatus according to claim 20, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

24. A projection exposure apparatus according to claim 18, wherein said at least one optical element has a stress distribution.

25. A projection exposure apparatus according to claim 24, wherein said at least one optical member is arranged so that a distribution, including a distribution of stresses produced by

said at least one optical member, is effective to cancel the birefringence of said plurality of lenses.

26. A device manufacturing method comprising the steps of:

exposing a wafer to a device pattern by use of a projection exposure apparatus as recited in claim 18; and

developing the exposed wafer.

27. (Amended) An optical system for use in a step-and-scan type projection exposure apparatus, said optical system comprising:

a plurality of optical elements each causing birefringence, said plurality of optical elements being arranged so that the birefringence of the optical system as a whole is substantially eliminated.

28. (Amended) A step-and-scan type projection exposure apparatus comprising:

an illumination system for illuminating a reticle with light; and

a projection system for projecting a pattern of the reticle onto a wafer, said projection system having a plurality of optical elements each causing birefringence, and said plurality of optical elements being arranged so that the birefringence of the optical system as a whole is substantially eliminated.

29. A device manufacturing method, comprising the steps of:
exposing a wafer to a device pattern by use of a projection exposure apparatus as recited in claim 28; and
developing the exposed wafer.

30. An optical system according to Claim 27, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having form birefringence.


31. An optical system according to Claim 27, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having a stress distribution.

32. A projection exposure apparatus according to Claim 28, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having form birefringence.

33. A projection exposure apparatus according to Claim 28, wherein said optical elements comprise a plurality of lenses each having birefringence and at least one element having a stress distribution.

Please ADD new claims 34-42 as follows:

--34. An optical system according to claim 12, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.



35. An apparatus according to claim 20, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

36. An optical system according to claim 30, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

37. An apparatus according to claim 32, wherein the amount of birefringence of said at least one optical element is substantially the same as the amount of birefringence of said plurality of lenses as a whole, and wherein the sign of birefringence of said at least one optical element is opposite to the sign of said plurality of lenses as a whole.

38. An optical system according to claim 30, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

39. A projection exposure apparatus according to claim 32, wherein said at least one optical element produces the form birefringence by a grating having a period smaller than a wavelength used.

40. A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus as recited in claim 32; and
developing the exposed wafer.

41. A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus as recited in claim 33; and
developing the exposed wafer.

42. A device manufacturing method, comprising the steps of:
exposing a wafer with a device pattern by use of a projection exposure apparatus as recited in claim 35; and
developing the exposed wafer.--.